CLASS XII · CBSE	PHYSICS	Date: _____
Time: 15 Minutes	WORKSHEET – 1	Max. Marks: 10

TOPIC: 10.1 INTRODUCTION · 10.2 HUYGENS' PRINCIPLE

Answer the following. Q. 1 to 7 carry 1 mark each; Q. 8 carries 3 marks.

1. According to Huygens' principle, the amplitude of secondary wavelets is **[1M]**

(a) equal in both the forward and the backward directions.

(b) maximum in the forward direction and zero in the backward direction.

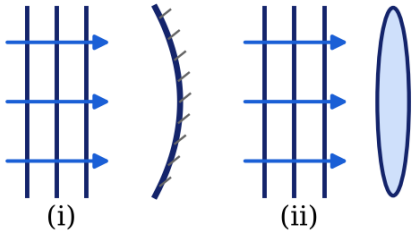
(c) large in the forward direction and small in the backward direction.

(d) small in the forward direction and large in the backward direction.

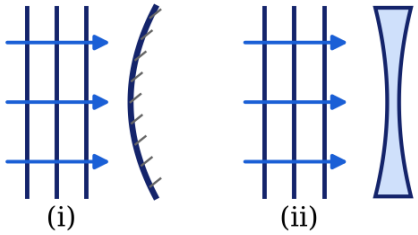
2. What is the shape of a wavefront emanating from (i) a point source and (ii) a linear source? **[1M]**

3. If the amplitude of light at 10 m from a small light bulb is A_0, find the amplitude of light at a distance of 50 m from the same bulb. **[1M]**

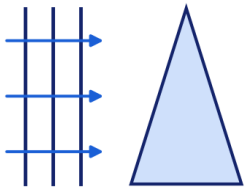
4. A plane wavefront is incident on the given optical device in each case — (i) a concave mirror and (ii) a convex lens. Draw the correct wavefront after the interaction of light with the optical device. **[1M]**



5. A plane wavefront of monochromatic light is incident on the given optical device in each case — (i) a convex mirror and (ii) a concave lens. Draw the correct wavefront after the interaction of light with the optical device. **[1M]**



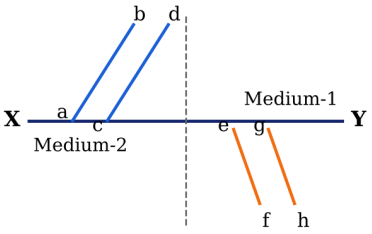
6. A plane wavefront of monochromatic light is incident on a prism as shown. Draw the correct wavefront after the interaction of light with the prism. **[1M]**



7. A plane wavefront is incident on a concave mirror of radius of curvature R. The radius of the reflected wavefront will be **[1M]**

(a) $2R$ (b) R (c) $R/2$ (d) $R/4$

8. A wavefront is a locus of points which vibrate in the same phase. A ray of light is perpendicular to the wavefront. According to Huygens' principle, each point of the wavefront is the source of a secondary disturbance, and the wavelets from these points spread out in all directions with the speed of the wave. The figure shows a surface XY separating two transparent media, medium-1 and medium-2. The lines ab and cd represent wavefronts of a light wave travelling in medium-1 and incident on XY. The lines ef and gh represent wavefronts of the light wave in medium-2 after refraction. **[3M]**



(i) A 'wavefront' is a surface of constant

(a) phase (b) frequency (c) wavelength (d) amplitude

(ii) The wavefront due to a source situated at infinity is

(a) spherical (b) cylindrical (c) planar (d) rectilinear

(iii) When monochromatic light travels from a rarer to a denser medium, which quantity does not vary?

(a) wavelength (b) speed (c) frequency (d) all of these

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CLASS XII · CBSE	PHYSICS	Date: _____
Time: 15 Minutes	WORKSHEET – 2	Max. Marks: 15

TOPIC: 10.3 REFRACTION AND REFLECTION OF PLANE WAVES USING HUYGENS' PRINCIPLE

Answer the following.

1. State Huygens' principle. How did Huygens explain the absence of the backwave? **[2M]**

2. Using Huygens' principle, prove the laws of reflection. **[3M]**

3. Using Huygens' principle, prove Snell's law of refraction. **[3M]**

4. Light of wavelength 5000 Å falls on a plane reflecting surface. What are the wavelength and frequency of the reflected light? For what angle of incidence is the reflected ray normal to the incident ray? **[2M]**

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CLASS XII · CBSE	PHYSICS	Date: _____
Time: 15 Minutes	WORKSHEET – 3	Max. Marks: 15

TOPIC: 10.3 REFRACTION AND REFLECTION OF PLANE WAVES USING HUYGENS' PRINCIPLE

Answer the following. All questions carry equal marks.

1. A plane wavefront is incident normally on a glass slab of refractive index 1.5. If the speed of light in air is 3×10^8 m/s, calculate the speed of the secondary wavelets inside the glass. **[3M]**

2. A light ray passes from air into water (refractive index = 1.33) at an angle of incidence of 45°. Using Huygens' construction, calculate the angle of refraction. **[3M]**

3. A wavefront travels 12 cm in a medium in 0.4 ns. Find (a) the velocity of light in the medium and (b) the radius of the secondary wavelet after 0.4 ns. **[3M]**

4. A monochromatic wave has wavelength 600 nm. Determine the phase difference between two points separated by 150 nm along the direction of propagation of the wave. **[3M]**

5. Using Huygens' principle, derive the radius of curvature of a spherical wavefront after it has propagated for a time t. **[3M]**

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CLASS XII · CBSE	PHYSICS	Date: _____
Time: 15 Minutes	WORKSHEET – 4	Max. Marks: 15

TOPIC: 10.4 COHERENT AND INCOHERENT ADDITION OF WAVES

Answer the following.

1. A laser beam is coherent because it contains **[1M]**

(a) waves of several wavelengths.

(b) incoherent waves of a single wavelength.

(c) coherent waves of several wavelengths.

(d) coherent waves of a single wavelength.

2. Two coherent waves have intensities 25 W/m² and 9 W/m². Find (a) the maximum intensity and (b) the minimum intensity. **[2M]**

3. Two coherent waves have equal amplitudes of 4 units. Find the resultant amplitude and intensity when the phase difference is (a) 0°, (b) 90° and (c) 180°. **[2M]**

4. Two incoherent sources each produce an intensity of 12 W/m². What is the resultant intensity? **[1M]**

5. A laser beam is split into two equal coherent beams. If each beam has an intensity of 40 W/m², calculate the maximum and minimum intensities after interference. **[2M]**

6. Four coherent waves, each of amplitude 2 units, are in phase. Calculate the resultant amplitude and the resultant intensity. **[2M]**

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CLASS XII · CBSE	PHYSICS	Date: _____
Time: 15 Minutes	WORKSHEET – 5	Max. Marks: 10

TOPIC: 10.4 COHERENT AND INCOHERENT ADDITION OF WAVES

Answer the following.

1. If two coherent waves have equal amplitudes A, what phase difference produces an intensity equal to half the maximum intensity? **[2M]**

2. Find the resultant intensity when two coherent waves of equal intensity interfere destructively. **[3M]**

3. The ratio of maximum to minimum intensity when two waves interfere is 16 : 9. Find the ratio of the amplitudes of the superimposing waves. **[2M]**

4. The amplitudes of two sources are in the ratio 2 : 1. Find **[3M]**

(a) I_1 / I_2 (b) I_{max} / I_{min} (c) A_{max} / A_{min}

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CLASS XII · CBSE	PHYSICS	Date: _____
Time: 15 Minutes	WORKSHEET – 6	Max. Marks: 10

TOPIC: 10.5 INTERFERENCE OF LIGHT WAVES AND YOUNG'S EXPERIMENT

Answer the following.

1. Consider sunlight incident on a slit of width 10^4 Å. The image seen through the slit shall

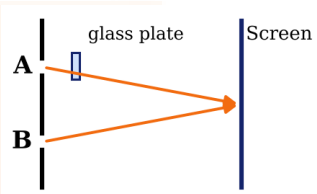
(a) be a fine sharp slit, white in colour at the centre.

(b) be a bright slit, white at the centre, diffusing to zero intensity at the edges.

(c) be a bright slit, white at the centre, diffusing to regions of different colours.

(d) only be a diffused slit, white in colour.

2. In Young's experiment, monochromatic light is used to illuminate the slits A and B. Interference fringes are observed on a screen placed in front of the slits. Now, if a thin glass plate is placed in the path of the beam coming from A, then



(a) the fringes will disappear.

(b) the fringe width will increase.

(c) the fringe width will decrease.

(d) there will be no change in the fringe width.

3. In Young's double-slit experiment, the source is white light. One of the holes is covered by a red filter and the other by a blue filter. In this case

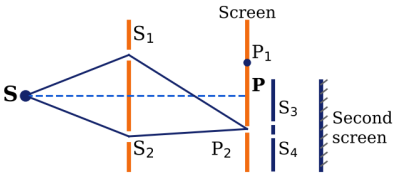
(a) there shall be alternate interference patterns of red and blue.

(b) there shall be an interference pattern for red distinct from that for blue.

(c) there shall be no interference fringes.

(d) there shall be an interference pattern for red mixing with one for blue.

4. The figure shows a standard two-slit arrangement with slits S_1 and S_2. P_1 and P_2 are the two minima points on either side of P. At P_2 on the screen there is a hole, and behind P_2 is a second two-slit arrangement with slits S_3, S_4 and a second screen behind them.



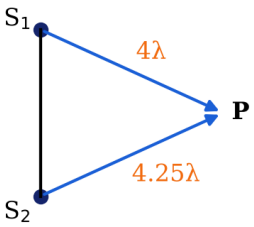
(a) There would be no interference pattern on the second screen, but it would be lighted.

(b) The second screen would be totally dark.

(c) There would be a single bright point on the second screen.

(d) There would be a regular two-slit pattern on the second screen.

5. Two coherent sources S_1 and S_2, each producing identical waves of intensity I_0 and wavelength λ, are at the distances from point P shown in the figure. Find the intensity of the resultant wave at P.



6. In Young's double-slit experiment, the slits are separated by 0.28 mm and the screen is placed 1.4 m away. The distance between the central bright fringe and the fourth bright fringe is measured to be 1.2 cm. Determine the wavelength of light used in the experiment.

7. In Young's double-slit experiment using monochromatic light of wavelength λ, the intensity at a point on the screen where the path difference is λ is K units. What is the intensity of light at a point where the path difference is λ/3?

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CLASS XII · CBSE	PHYSICS	Date: _____
Time: 15 Minutes	WORKSHEET – 7	Max. Marks: 10

TOPIC: 10.6 DIFFRACTION

Answer the following. All questions carry 1 mark each.

1. In Young's double-slit experiment, the fringe width will remain the same if (D = distance between screen and plane of slits, d = separation between the two slits and λ = wavelength of light used) **[1M]**

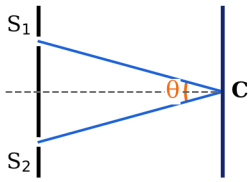
(a) both λ and D are doubled (b) both d and D are doubled

(c) D is doubled but d is halved (d) λ is doubled but d is halved

2. In Young's double-slit experiment, the distance between the slits is 1 mm and that between the slits and the screen is 1 m. If the 10th fringe is 5 mm away from the central bright fringe, the wavelength of light used is **[1M]**

(a) 5000 Å (b) 6000 Å (c) 7000 Å (d) 8000 Å

3. Young's double-slit arrangement is as shown in the figure. If λ is the wavelength of light used and $\angle S_1CS_2 = \theta$, then the fringe width will be **[1M]**



(a) λ/θ (b) $\lambda/2\theta$ (c) $\lambda\theta$ (d) $2\lambda/\theta$

4. In Young's double-slit experiment, fringes of width β are produced on a screen kept at a distance of 1 m from the slits. When the screen is moved away by 5×10^{-2} m, the fringe width changes by 3×10^{-5} m. The separation between the slits is 1×10^{-3} m. The wavelength of the light used is **[1M]**

(a) 400 nm (b) 500 nm (c) 600 nm (d) 700 nm

5. In Young's double-slit experiment, the intensity of light at a point on the screen where the path difference is λ is K (λ being the wavelength of light used). The intensity at a point where the path difference is $\lambda/4$ will be **[1M]**

(a) K (b) $K/4$ (c) $K/2$ (d) zero

6. For a parallel beam of monochromatic light of wavelength λ, diffraction is produced by a single slit whose width a is of the order of the wavelength of the light. If D is the distance of the screen from the slit, the width of the central maximum will be **[1M]**

(a) $2D\lambda/a$ (b) $D\lambda/a$ (c) Da/λ (d) $2Da/\lambda$

7. In Young's double-slit experiment, using two coherent waves of different amplitudes, the ratio of intensities of bright and dark fringes is 3. The ratio of the amplitudes of the waves arriving there is **[1M]**

(a) $(\sqrt{3}+1)/(\sqrt{3}-1)$ (b) $(\sqrt{3}-1)/(\sqrt{3}+1)$

(c) $\sqrt{3}:1$ (d) $1:\sqrt{3}$

8. What is necessary for the easy occurrence of Fresnel diffraction? **[1M]**

(a) The obstacle should be of the order of the wavelength.
(b) The narrow opening should be of the order of the wavelength.
(c) The source and screen should be at a finite distance from the obstacle.
(d) All of the above

9. In Fraunhofer diffraction, the centre of the diffraction image is **[1M]**

(a) always bright
(b) always dark
(c) sometimes bright and sometimes dark
(d) bright for large wavelength and dark for small wavelength

10. For Fraunhofer single-slit diffraction, **[1M]**

(a) the width of the central maximum is proportional to λ.
(b) on increasing the slit width, the width of the central maximum decreases.
(c) on making the slit width $a = \lambda$, the central maximum spreads in the range ±90°.
(d) all of the above.

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CLASS XII · CBSE	PHYSICS	Date: _____
Time: 15 Minutes	WORKSHEET – 8	Max. Marks: 10

TOPIC: 10.6 DIFFRACTION

Answer the following.

1. In a single-slit diffraction experiment, the width of the slit is made double its original width. Then the central maximum of the diffraction pattern will become **[1M]**

(a) narrower and fainter (b) narrower and brighter

(c) broader and fainter (d) broader and brighter

2. A linear aperture whose width is 0.04 cm is placed immediately in front of a lens of focal length 30 cm. The aperture is illuminated normally by a parallel beam of wavelength 10×10^{-5} cm. The distance of the first dark band of the diffraction pattern from the centre of the screen is **[1M]**

(a) 0.20 cm (b) 0.15 cm (c) 0.10 cm (d) 0.075 cm

3. A slit 4.0 cm wide is irradiated with microwaves of wavelength 2.0 cm. Find the angular spread of the central maximum, assuming incidence normal to the plane of the slit. **[2M]**

4. A slit of width d is illuminated by white light. For what value of d will the first minimum for red light ($\lambda = 6500$ Å) fall at an angle $\theta = 30°$? **[2M]**

5. A screen is placed 2 m away from a single narrow slit. Calculate the slit width if the first minimum lies 5 mm on either side of the central maximum. The incident plane waves have a wavelength of 5000 Å. **[2M]**

6. Light of wavelength 5500 Å falls on a slit of width 0.13 cm at normal incidence. Calculate the width of the central maximum on a screen kept 2.5 m away from the slit. **[2M]**

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CLASS XII · CBSE	PHYSICS	Date: _____
Time: 15 Minutes	WORKSHEET – 9	Max. Marks: 10

TOPIC: 10.6 DIFFRACTION

Answer the following. All questions carry 2 marks each.

1. The width of the central maximum is 2 cm in a single-slit diffraction pattern for a slit of width 0.3 mm. What is the distance of the screen for λ = 600 nm? **[2M]**

2. For what distance is ray optics a good approximation when the aperture is 3 mm wide and the wavelength is 500 nm? **[2M]**

3. Determine the angular separation between the central maximum and the first-order maximum of the diffraction pattern due to a single slit of width 0.25 mm when light of wavelength 5890 Å is incident on it normally. **[2M]**

4. The intensity at the central maximum (O) in Young's double-slit experiment is I_0. If the distance OP equals one-third of the fringe width of the pattern, show that the intensity at point P would be $I_0/4$. **[2M]**

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